Possible financing schemes for one-stop-shop service for sustainable renovation of single-family houses

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1 EXECUTIVE SUMMARY

There are significant potentials to improve energy efficiency of single-family houses in the Nordic countries. Technical solutions exist, but there are market and financial barriers to implementation of such measures. The aim of this report is to identify financial barriers to implement energy efficiency measures in Nordic single family houses and to discuss options to address those barriers.

In the initial phase of a market formation, the targeted potential customers (the "innovators" who are few in numbers) usually have capacity to invest in energy-efficient measures. However, such measures, though cost effective in a life-cycle perspective, often incur high investment cost and majority of the consumers tend to stick to the least efficient products. Moreover, a lack of awareness about the possible energy efficiency measures, including their benefits, and the uncertainty regarding the level of energy savings due to a lack of standardised measurements and verifications protocol may not encourage, both the customers and financiers, to go for energy efficiency investments. Financiers perceive energy efficiency projects as risky investments maybe because of their small size, difficulty to control energy use behaviour of the occupants and the difficulty to predict future energy prices.

The options to finance energy efficiency renovations include homeowners' own resources, mortgage refinancing, flex loan, personal loan, financing by service providers, preferential loan, subsidies/grants, credit cards, and financing supported by guarantee on energy savings. Each option has its own advantages and disadvantages. It is less likely that the one-stop-shop service providers in Nordic countries, at present, will give any guarantee on actual savings in energy use or cost. But, such a concept is emerging in some European countries and could be an option in future.

The best option to finance energy efficiency improvements in Nordic countries seems to be that one-stop-shop service providers collaborate with commercial banks to offer mortgage refinancing. Such a mechanism is convenient for the homeowners, and banks will have a less risky asset in their portfolio. In situations where homeowners cannot avail additional mortgage financing, e.g. those who recently purchased a house and used the limit to such loans, banks may consider an energy efficient renovation plan prepared by an entrepreneur and pre-evaluate the post-renovation value of the house. This pre-renovation valuation could form the basis for the bank to confirm the homeowner and the service provider that certain amount of investment cost would be available from mortgage refinancing. To cover the cost that exceeds the amount available from mortgage financing (or base loan), national governments may consider to provide soft loans or subsidies.

In countries where tax deduction on home renovation is available, amendments should be made to such programs to incorporate specific requirements regarding energy efficiency of implemented measures. Also, higher tax deduction could be offered for energy efficiency improvement than for other renovation. Moreover, a simple tool to inform the homeowners about the cost-efficiency of energy renovation investment would be that banks and utilities collaborate to send a joint invoice which contains the monthly cost of mortgage loan and the energy cost.

2 INTRODUCTION

Increased energy efficiency and enhanced use of renewable energy resources reduce greenhouse gas (GHG) emissions, therefore mitigating climate change and reducing dependence on fossil fuels such as petroleum. The European Parliament also overwhelmingly voted for a resolution on binding energy efficiency improve target of 20% for the European Union (EU) by 2020 (European Parliament, 2010). The building sector uses about 40% of the final energy and contributes 36% of greenhouse gas emissions in the EU (European Parliament, 2010), and there is considerable potential for this sector to reduce primary energy use and GHG emissions. The greatest potential lies in improved energy efficiency of the operating phase which dominates the life cycle energy use of a building. In Nordic countries about 60% of final energy use in buildings is for space heating and hot water purposes.

Single-family houses (excluding row houses) account for an average of 40% of the dwelling stock in the Nordic countries, varying from 30% in Sweden to 57% in Norway (Tommerup et al., 2011). More than 80% of these buildings were built before 1980 when energy efficiency was given less priority in the building codes. Being more than 30 years old, majority of these buildings need renovation (Tommerup et al., 2011). Opportunities for thorough improvements of the building envelope and technical installations occur with a long interval. So it is important to effectively use these opportunities to upgrade the energy performance of the whole building or specific building components up to, and preferably beyond the current requirements in the building code.

Technical solutions exist for residential energy efficiency improvement (Tommerup et al., 2011). However, there are several barriers to implementation of such measures. They include e.g. (a) market barriers such as low priority given to energy issues by the stakeholders, especially the end-users, information limitations, split incentives, and price distortions and (b) financial barriers such as access to capital, and various risks and uncertainties (IEA, 2008).

The aim of this report is to identify financial barriers to implement energy efficiency measures in Nordic single family houses and to discuss options to address those barriers. Especially, attention is given to the concepts of energy performance contracting (EPC) and energy service companies (ESCOs). The European Parliament also recognizes that there are financial barriers to energy efficient renovation of existing buildings and seeks proposals for an EU framework of financial instruments to address the barriers (European Parliament, 2010).

This report is mainly based on inputs from the project partners and information collected from secondary sources such as journal publications, conference proceedings, reports, newspapers, statistical databases, and a general web search.

3 FINANCIAL BARRIERS TO IMPLEMENT ENERGY EFFICIENCY MEASURES IN RESIDENTIAL BUILDINGS

3.1 High investment cost

Lack of access to capital or higher priority given to non-energy issues may limit investments in energy efficiency measures. Energy-efficient products usually are cost effective in a life-cycle perspective, but often incur high investment cost and consumers tend to stick to the least efficient products (Brown, 2001). Especially, the high investment cost of some building energy efficiency measures may deter their adoption (Jensen, 2009). Swedish homeowners, especially those who were older and had lower income, reported that investment cost was one of the most important factors in their decision not to install a new heating system (Mahapatra and Gustavsson, 2008) and implement building envelop measures such as improved insulation and energy efficient products (Nair et al., 2010a). In Finland, many people who have recently purchased a house have used all their financial means for this purpose, and they typically don't have capacity to invest much in the renovation. In a study from year 2000 (Vainio et al. 2002), 43% of the owners of single-family houses built before 1960 reported problems in financing as reason why the house was not renovated even if it was in need of renovation. However, in the initial phase of a market formation, the targeted potential customers (the "innovators") usually have capacity to invest.

3.2 Lack of standardised measurements and verifications protocol

A lack of standardised measurements and verifications protocol for energy efficiency investments (Ramesohl and Dudda, 2001; IEA, 2008) creates uncertainty among the financers and customers regarding the level of energy savings to be achieved. Financiers need to spend more time on the evaluation of every single energy-efficient project compared to the average time they will spend on other investments. Commercial bankers are likely to be interested to invest in projects which are easily replicable, and for which evaluation is standardised.

3.3 Perceived risks

Energy efficiency projects are viewed as risky investments (BPIE, 2010; IEA, 2008), maybe because of their small size, difficulty to control energy use behaviour of the occupants and the difficulty to predict future energy prices. Commercial bankers typically pick investments which are safest and grant medium return on investments. The consideration given to such investment criteria along with financiers' lack of awareness on energy efficiency issues are obstacles to energy efficiency investments (BPIE, 2010). They give inadequate attention to the fact that implementation of energy efficiency measures improves credit capacity of the customers (IEA, 2008).

For single family houses the banks' major concerns are the market value of the house vs. total loan (i.e. security for the bank) and the ability to pay back the loan. Banks are willing to lend money to those homeowners whose existing house loan is considerably lower than the value of the house and the household income is sufficient to cover an increase of the loan. In fact banks are looking for good reasons to encourage such people to increase their loans. However, if the outstanding loan is close to

the market value of the house (e.g. in case of a newly bought house) or the household income is not high enough to payback the cost of the increased loan, banks see little potential in increasing their business without increasing their risk profile.

Typically, "payback time" is used as an investment decision tool (Hermelink, 2009). Energy efficient projects do not rank high on financiers' agendas since such projects tend to have a longer payback period than more classical investments (BPIE, 2010; IEA, 2008; Golove and Eto, 1996). Kragh and Rose (2011) noted that a barrier for energy efficiency investments in Denmark is that the homeowners consider that the payback period for energy renovations is very long, even with increased energy prices. However, use of this tool in the context of energy efficiency investments has several limitations. First, it does not consider benefits accrued after the payback time which is particularly important in the building sector context since buildings' lifetime usually exceeds the assumed 30 years period (IEA, 2008; Hermelink, 2009). Second, there is no agreement on the appropriate level of the discount rate which should be applied in the calculations (Thompson, 1997; Hermelink, 2009).

3.4 Lack of consideration of non-energy benefits

There are several non-energy *benefits* with implementation of building energy efficiency measures, especially when a building is renovated. For example, the improved indoor air quality and comfort level is likely to have health benefits, and the value of house may increase. A study in USA showed that residents rated non-energy benefits higher that energy benefits of energy efficiency measures (Skumatz et al., 2000). Energy utilities could also be benefitted by reductions in cost with recovery of payments from low-income households (Howat and Oppenheim, 1999). However, it is difficult to evaluate such benefits (Jakob, 2006). Systematic post-evaluation is too costly, while the existing methods for pre-evaluation maintain a certain level of uncertainty (IEA, 2008). Especially it is difficult to judge the cost effectiveness of a measure that would be implemented *anyway* if the existing installation was old or damaged. This is an important issue, since majority of the single-family house stock in the Nordic countries is more than 30 years old and in urgent need of renovation.

4 FINANCING OPTIONS FOR ENERGY EFFICIENT RENOVATIONS OF SINGLE FAMILY HOUSES

4.1 Homeowners' own resources

Homeowners can use their own savings for renovations of any kind. This option is especially appropriate for small scale or do-it-yourself renovations as homeowners may not like to take a loan if the cost involved is not significant. However, step-by-step renovations like this may not adequately reflect the increased value of the house compared to if such measures are presented as a complete project to the bank and with a documented better energy performance label. Using own savings may also depend on homeowners' willingness and opportunity to invest elsewhere, e.g. in capital market. Also, if homeowners finance the renovation through mortgage house loan, they have to arrange the amount that is not covered by the loan.

4.2 Mortgage refinancing

Mortgage means to pledge a property as security to obtain a loan from a financial institution. Mortgage house loan, usually from banks, is common for house purchase. In Nordic countries, except for Finland such a loan usually has two parts: a base loan with longer amortization period (can go up to 50 years) and lower interest rate and a top loan with shorter amortization period (can be 10-30 years) and higher interest rate. The share of and interest rates for each portion may vary from country to country (see Table 1 for an example). The interest rates are usually negotiable to certain extent depending on customer situation (economic condition and the loan size) and vary from bank to bank. The amount that can be borrowed is regulated as a specific percentage of the (e.g. 85% in Sweden) appraised value of the house. The remaining funds have to be arranged by the homeowner. The interest rate for mortgage financing is usually much lower than credit card or personal loan rates. The payment can be spread over a long period.

Banks are interested to give house loans to those homeowners who have low remaining loan and potential to payback. Such "safe" customers could form the niche market to create interest among the banks to finance energy efficient renovation. With increased knowledge and experience over time, the banks might be interested to grant loans to other customers. However, in the absence of any database about household situation of the customers, including information about condition of the house and household energy use, it might be difficult to give a supply-side push to locate such homeowners interested in energy efficient renovation. A database of energy certificates could be created, which energy renovation companies should be able to use. Such a database exists in Denmark and reports are publicly available, but information on actual energy use can be accessed by the homeowners only. Another possibility is that energy efficient renovation companies or banks cooperate with energy utilities to get access to household energy use statistics, but utilities may not cooperate if they are not interested in energy efficient renovations or secrecy laws prevent them to share household information with third parties. However, renovation companies may use local knowledge about houses to identify potential customers.

Table 1: Mortgage financing in Nordic countries (as of *Feb. 21, 2011*)

Mortgage house loan	Denmark	Finland	Norway	Sweden
Ceiling (% of appraised value of a house)	95%	90% (Svenska Bankföreningen, 2010)	90 %	85%
Base loan with lower interest rate (% of appraised value of a house)	75% if amortization period greater than 30 years	75%	75 %	75%
Annual nominal interest rate (variable rate for base loan normal customers; Basis/Normaalihinta/non-förmånskund) *as published in* Nordea bank*'s websites on Feb. 21, 2011*	1.55%	1.80% (Nordea Prime rate)	4.15% (for more than 1 million NOK loan	3.50%
Tax rebate (% of total interest)	33%	See description on interest on loans *	28 %	30%

* If you have a loan from a financial institution, the interest you pay is tax-deductible if you use the borrowed money to finance your principal place of residence, to pay for studies, or for most business endeavours. Interest is non-deductible for almost all other loans - including, of course, credit-card borrowing to buy consumer goods. (http://www.vero.fi/?path=488,684&domain=VERO_ENGLISH&language=ENG, accessed on March 8th, 2011)

For major renovations, homeowners can *refinance* their mortgage to an amount equivalent to the mortgage ceiling minus any outstanding mortgage balances. Hence, households who have lived in a house for long time and paid back a significant portion of the mortgage have better opportunity to refinance their mortgage than those who have bought a house recently. In the latter situation, an estimated post renovation valuation of a house might be used for mortgage refinancing. Kragh and Rose (2011) noted that in Denmark homeowners on an average have taken mortgage loans up to 60% of the assessed value of the house. Since, the loan ceiling is 80%, homeowners can avail mortgage financing for energy renovations, the cost of which is estimated to be lower than or similar to energy cost savings (Kragh and Rose, 2011).

Table 2: Institutions providing *household* loans; some info, e.g. size, nation-wide presence

Organizations providing *household* loans (housing, cars, etc.)	Denmark	Finland	Norway	Sweden
Commercial banks (Prominent)	Danske Bank Nordea Jyske Bank Sydbank Nykredit Bank	Nordea Sampo OP-Pohjola Aktia Säästöpankki Tapiola Handelsbanken Ålandsbanken	Nordea Dnb Nor Sparebank1 Fokus Bank (own by Danske Bank)	Nordea Swedbank SEB Handelsbanken Länsförsäkringar SkandiaBanken Danske Bank

Housing bank	Nykredit Realkredit, Realkredit Danmark (part of Danske Bank Group) Nordea Kredit BRFkredit DLR Kredit	Suomen AsuntoHypo Pankki Oy	In 2000: 13% market share*	Do not exist
Other _____			KLP (Kommunenes Landspensjons-kasse) Storebrand (insurance company) Several smaller savings banks	Various savings banks

*http://www.regjeringen.no/nb/dep/krd/dok/nouer/2002/nou-2002-2/17.html?id=366458

Several organizations provide household loans, but commercial banks dominate. For example, in Sweden the seven large banks provide about 90% of the household loans (Table 2). In Norway, the housing bank extends house loans mostly to low income households. Due to their market dominance, knowledge on housing market, and first hand contact with homeowners, these banks are important players in energy efficient renovations. Their knowledge and attitude towards energy efficiency will influence not only the availability of financing, but also the degree to which they may encourage homeowners to go for energy efficient renovations. However, traditionally, financiers are familiar to commercially financed (energy efficiency) large-scale renovation projects (IEA, 2008). Small scale projects, even if they are cost effective in long-term, are considered uneconomic due to a limited understanding of energy-efficiency, uncertainties associated with energy savings, and a limited volume of credit (ECS, 2004).

The appraised market value of a house steers the size of the mortgage loan that homeowners can avail from a bank. Real estate agents might be asked to estimate the post-renovation value of house (currently such a service is free of cost in Sweden), which will form the basis for a confirmation of size of mortgage financing for renovation. A real estate agent from one of the largest Swedish real estate agency company (Fastighetsbyrån in Östersund) mentioned the following about the impact of energy efficient measures on the value of a house (Persson, 2010; own translation from Swedish).

“Operating expenses for a house affect pretty much the final price of the dwelling. Implementation of energy efficiency measures that reduces heating costs significantly (about 50%) are likely to increase the sale price, but it is difficult to say exactly how much, as it varies greatly between different locations and different houses. The price increase could be as much as the investment cost of the measures, but it may not be possible to "earn" from the energy efficiency investments. Furthermore, the investment costs must be considered in a longer time perspective. Hence, for a prospective seller of a house, it is rarely relevant to invest investment intensive energy efficiency measures as there is no guarantee to get the money back”.

Assuming that the post-renovation value of house increases as much as the investment cost, a Swedish homeowner may mortgage finance up to 85% of the investment cost. The rest must be arranged from own savings or from other sources (such as personal loan) at a higher interest rate. A

lack of access to this extra capital or the higher cost incurred may be an obstacle to investment intensive renovations.

4.3 Flex-loan

Similar to the personal line of credit option in North America, some banks in Nordic countries offer flexible mortgage loans (Flex-loan) to customers who have lower loan than the market value of their house. The house owner may withdraw funds up to a specific percentage of the appraised value of a house to finance any purpose (s)he wishes. The interest rates are lower than for credit cards, and interest is charged only on funds used. There is no requirement to pay back the capital. Once the borrowed amount is paid back, homeowner can use it again without re-applying. The interest rate may be the same or higher than a fixed house loan.

4.4 Personal loan

These loans are without security and for short duration, typically one to five years but can be for longer periods (e.g. up to 12 years by Nordea bank in Sweden). These loans can be availed from several financial institutions including banks. The interest rate is typically less than that of a credit card, but higher than mortgage loan, for example 7-8% in Sweden (as of Feb. 21, 2010).

4.5 Financing by the service providers of one-stop-shop

In Denmark, DONG Energy Cleantech offers financing of DKK 15,000 – 250.000 through a financing company (Nordea Finans Danmark A/S). The loan is offered with no security and therefore the interest rate is rather high. DONG Energy also co-operates with banks affiliated to the mortgage credit institution Totalkredit. The bank refers homeowners to DONG Energy Cleantech solutions and can finance the bought solutions. The co-operation between DONG Energy and Totalkredit/banks is a "superstructure" of the calculator Totalkredit Miljøberegner, which gives homeowners an indication of energy saving potential. If the homeowner accepts an offer from DONG Energy, the homeowner's bank will help with a mortgage house loan through Totalkredit.

In Sweden, there is no one-stop-shop service at present. However, in an earlier occasion, the energy utilitiy "Jämtkraft", collaborated with Nordea bank to offer the homeowners in Östersund long term flexible loans to convert from resistance heating to district heating.

In Finland, renovation service providers sometimes offer financing in collaboration with specific banks. For example, K-Rauta (the warehouse chain) offers one-stop-shop renovation service including financing in collaboration with the bank OP-Pohjola Pankki Oy. Homeowners can get a loan up to €7500 and there is no interest for first six months. The interest rate was OP-prime 4.95% (about 6.5 % in 4/2010).

In Norway, no one-stop-shop solution exists at present.

The advantage of financing by service provider is that homeowners, especially those who may find it difficult to obtain mortgage refinancing, will be more certain about financial possibilities for their energy efficiency renovation. As in case of Jämtkraft, the service provider may collaborate with commercial banks who may offer low interest and long amortization loans for energy efficiency

renovations. In absence of such a system, the service provider has to take greater financial risks and therefore, the interest rate is likely to be high. This means the monthly cost for the homeowner in this option may be higher. Cost efficiency must be high to attract more homeowners for energy efficient renovation of their houses.

4.6 Preferential loans

In some European countries there are dedicated funds which offer preferential loans to residential building owners to invest in energy efficiency measures. For example, Nordic Investment Bank (NIB) is the common international financial institution of the eight Nordic and Baltic countries. NIB provides long-term financing to the energy, environmental, transport, logistics and communications, and innovation sectors for projects that strengthen competitiveness and enhance the environment. Intermediate banks can avail financing from NIB to provide loans for energy efficiency or renewable efficiency investments in single-family houses.

Finland

The Mortgage Society of Finland (Suomen Hypoteekkiyhdistys)

In May 2010, a loan from NIB amounting to EUR 12 million was sanctioned to the Mortgage Society of Finland to sub-loan the amount to private households and housing companies for energy-efficiency renovation investments. The projects might include, for example, installation of heat pumps, pellet heating systems, small-scale wind power or solar panels.

Oulun Osuuspankki

Oulun Osuuspankki is one of the largest member cooperative banks in Finland's OP-Pohjola Group and is the market leader in retail banking in the Oulu region, northern Finland. In December 2010, this bank received a 10-year-maturity loan totalling EUR 15 million from the NIB to sub-loan private households, housing companies, SMEs and large corporations to invest in projects that are in line with the NIB eligibility criteria. Sub-loans are to fall for example into renovation of existing constructions that either reduce emissions to the air and improve buildings' energy efficiency or replace fossil fuel-based energy with renewable energy: for instance, connection to a district heating system, heat pumps, solar panels, changing windows, heat insulation of roofs, walls and floors, connection to a district cooling system, the installation of heat recovery systems.

Norway

In Norway, the Norwegian Housing Bank (NSHB) provides preferential loans to residential building projects with strong environmental focus. Loans of up to 90% financing are offered to new low energy housing, passive houses and up to 100% of environmentally-benign renovations (if the total mortgage is within 90% of the value of the house after renovation) and modernizations that qualify for the Swan Nordic Ecolabel (EuroACE, 2010).

Estonia

The EU structural funds can be combined with loans from financial institutions to create revolving funds[1] for energy efficiency of the residential sector of the member states. In Estonia, such a "revolving fund scheme for energy refurbishment in housing" has been created with financing from the European Regional Development Fund (ERDF) and loans from the Council of Europe Development Bank (CEB) and funding from The Credit and Export Guarantee Fund (KredEx). The aim of this fund created in 2009 is to support the renovation of *apartment* buildings and to raise their energy efficiency at least by 20% by improving the accessibility of capital through KredEx. The loans are for 20 years with 10 year fixed interest rates (BPIE, 2010; EuroACE, 2010). The repayments to the loan are used again for new loans.

France

In France, a government funded green loan for social housing (2009-2020) aims to finance renovation of 800,000 social housing units. €1.2 billion of loan with a fixed rate of 1.9% on 15 years is available to finance the restoration of the first 100,000 social housing units (EuroACE, 2010).

Germany

Germany has a special fund to finance energy efficiency improvements of existing buildings. The CO_2 Building Rehabilitation Programme launched in 2001 provides soft loans[2] to private individuals, housing companies, housing cooperatives, operators of residential establishments, and municipalities for energy efficient renovation of buildings constructed before 1979. Introduction of the soft loan program was based on the previous experience, that the loans were more cost-efficient than the subsidies (Korytarova, 2006). The implementation body for the incentive program is the Bank of Reconstruction (Kreditanstalt für Wiederaufbau, KfW). Applicants can submit their applications through their regular banks. Since 2006, more than 800,000 homes have been renovated to a higher energy standard (Rockwool, 2010).

The programme provides soft loans of up to 50,000 euro per housing unit (Rockwool, 2010), which can cover up to 100% of the investment costs including ancillary costs such as service of architects and advice on how to save energy (Korytarova, 2006) The interest is lower than market rate (for example, 2% lower than the market rate in December 2005), but depends on the extent to which building renovation measures reduce CO_2 emission and the length of amortization. The higher the CO_2 emission reduction, lower is the interest rate. If the renovation brings the building's energy use to the level of a new building standard, 5% of the loan is waived. If a level more than 30% below the new building standard is reached, the waiver increases to 12.5% of the loan (Rockwool, 2010).

During 2003-2005, the condition to obtain a loan was that a package of measures (not individual measures) must be implemented. The program offered 6 packages of measures. Packages 0 to 3

[1] A fund established for a certain purpose, such as making loans, with the stipulation that repayments to the fund may be used anew for the same purpose (The American Heritage® Dictionary, 2000).

[2] Financing that offers flexible or lenient terms for repayment, usually at lower than market interest rates. Soft loans are provided customarily by government agencies and not by financial institutions (http://www.businessdictionary.com/definition/soft-loan.html).

include combinations of additional insulation in the building envelop, installation of energy efficient windows and/or heating systems. When such packages were implemented, no energy audit was required for loan waiver, as they were assumed to reduce the minimum required CO_2 emission by 40kg/m^2 of living space/year (Korytarova, 2006).

Lithuania

The JESSICA (Joint European Support for Sustainable Investment in City Areas) mechanism allows member states to make repayable investments in projects forming part of an integrated plan for sustainable urban development. In Lithuania, such a fund has been established with funding from ERDF, European Investment Bank and the national government. The purpose of the fund is to invest in housing energy efficiency projects through the banking sector in Lithuania. The fund provides long-term loans with fixed interest rates to owners of multifamily houses built before 1993 (BPIE, 2010).

4.7 Subsidies/grants

Homeowners can use various investment and tax subsidies to implement energy efficiency measures. See Table 3 for a list of subsidies in Nordic countries.

Table 3: Subsidies/grants for energy efficiency measures in the Nordic countries (adapted from Haavik, 2011)

Kind of subsidy	Denmark	Finland	Norway	Sweden
Energy analysis of the house (thermog)	No	Tax credits for labour costs. Max € 3000 per year per person in total for all labour costs*	Support by Enova and by an NGO	No
Energy efficient windows:	In 2009, funds was set aside for renovation of res. buildings, incl the possibility to get 20% subsidy for energy efficient windows	Tax credits for labour costs. Max € 3000 per year and per person in total for all labour costs*	No	2006-2008: 30 % of costs that exceed SEK 10.000. Max subsidy SEK 10.000
Heating: From resistance heaters to districts heating, brine/water based heat pump or biomass heating system	Replacement of oil-fired burners with sustainable energy supply solutions: Heat pump, brine-water: DKK 20,000,- HP, air-water: 15,000,- District heating: 10,000,- Solar : 25% of total cost"	From 2011, 20 % of the accepted costs Tax credits for labour costs. Max € 3000 per year and per person in total for all labour costs*	Up to10000 NOK for installing air to water or water to water HP and Biomass systems or pellets stoves.	2006-2010: 30 % of the labour and material costs of installation. Max SEK 30.000.
Solar Water heaters	Yes – see above	Tax credits for labour costs. Max € 3000 per year and per person in total for all labour costs*	Subsidy of 20% of costs, maximum NOK 10.000,-	2001-onwards. Since 2009, 2.50 SEK/kWh/years for the heat produced. Max SEK 7500 per house

Kind of subsidy	Denmark	Finland	Norway	Sweden
Radon decontamination in single family houses	No	Max subsidy of 70 % if radon exceeds 200 Becquerel/m^3 in indoor air. Renovation costs must be over 7.000 €. Also available for other health-related renovation(mould)	No longer.	When radon exceeds 200 Becquerel/m3 indoor airs: Max subsidy 50 % of cost for undertaken measure. Max SEK 15.000.
Subsidy for low income families	No	In 2010, maximum of 25 % of the accepted costs for improving energy-efficiency or implementation of renewable energy[3]	No	No
Loans	No	No	90% of cost from State bank. One private bank offers better terms for low energy houses.	No
Tax deductions	No	Tax Credit [4] for domestic help for household improvement / home repair. Only for the work performed, not for materials.	No special tax deductions for energy efficiency measures in households.	From 1.6.09 private persons can get tax subsidy up to 50 % of the labour cost for maintenance, renovation or extension work in a single-family house or tenant-owned apartm. The max. claim allowed is SEK 50000/person/year. Can be combined with subsidy to replace resistance heaters or to decontaminate radon in single family houses.

*This means per year for all types of renovation and other household work in total.

Subsidies reduce the investment burden and may encourage homeowners who otherwise may not implement energy efficiency measures. Subsidies are useful to reach a critical mass of early adopters of a product/service, who usually pass on their experience to potential adopters through interpersonal communication. Thus, the diffusion process becomes self-sustainable. However, the effectiveness of the subsidy depends on its size, awareness among the potential recipients, and the recipients' perception of the relevance of the measures for which the subsidy is given. Mahapatra and Gustavsson (2008) reported that, in Sweden, approximately 50% of the homeowners with resistance heater and 30% of the homeowners with oil boilers thought that investment subsidy was important for them to install environmentally benign heating systems. Similarly, Nair et al. (2010a) reported that only about 35% of the Swedish homeowners were aware of the existence of any government support for reducing household energy use and 50% among them thought that investment subsidy was important in their decision to implement energy efficiency measures.

One issue with investment subsidy is the *free riders,* i.e. customers who are benefited by a program even though they would have installed the measures without the program (Train, 1994). The free rider fraction in a subsidy program varies depending on the technology, and subsidies on

[3] www.ara.fi
[4] http://www.tax.fi/

technologies that have many free riders are not cost effective (Aalbers et al., 2004). Some Dutch studies suggest that proportion of free riders could be 30-50% (Joosen et al., 2004 cited in Korytarova, 2006) or 50-70% (Aalbers et al., 2004). In Sweden, 54% of the respondents to a survey, who availed investment subsidy to install energy efficient windows, stated that they would have installed the windows even without the investment subsidy (based on Nair et al. 2010b).

One idea to finance the subsidies would be a combination of subsidies and low-interest loans from government. In this model the subsidies would be at least partly financed through the funds raised from the interests.

4.8 Credit card and other consumer goods financing

This option may be useful for small investments up to the credit limit of the card. Personal economic situation defines the credit limit. Usually, there is no interest charge during the month of transaction, but beyond that the rate is very high.

Several products are sold through retailers as “buy today and pay in half a year”. GE Moneybank is a leading bank in this segment. The consumer is typically offered an interest free loan for the defined period, but thereafter the interest is rather high.

4.9 Financing through funds received from energy savings: The EPC and ESCO concepts

Energy Performance Contracting (EPC) is a form of ‘creative financing’ for capital improvement where cost savings from implementation of energy efficiency measures is used to repay the costs of the project, including the investment costs. Energy Service Companies (ESCOs) enters into an agreement with property owners to improve energy efficiency of their property by implementing various measures. The remuneration of ESCOs is directly linked to demonstrated performance regarding the level of energy savings or energy service (JRC, 2010).

Till date ESCOs have focused almost exclusively on industrial sector and public buildings. The main reasons for almost no activity in residential sector are as follows.

1. Energy and cost saving possibilities of a single project/ site are usually small compared to the transaction costs especially in cases when ownership of buildings is dispersed among many private owners (Grim, 2005).

2. Payments based on energy savings can be risky as energy use significantly varies among households. The inability to control occupant behaviour (e.g. indoor temperature, window openings) reduces the effectiveness of upgrades particularly in rented properties where tenants may not have financial incentives to reduce energy use (JRC, 2010).

3. Rent control may limit returns on energy investments. When energy cost is included in house rent, property owners have no incentive to implement energy efficiency measures (JRC, 2010).

4. Approval processes are complicated by the range of ownership, e.g. single-family houses, cooperative housing associations, and rented apartments (JRC, 2010).

5. Building owners are often not aware of or interested in energy saving potentials and the opportunities which EPC offers (Javaroni and de Aragao Neto 2006).

6. Many building owners mistrust the projected saving potentials mainly because the motivation for the EPC mechanism is not understood (Bertoldi and Rezessy, 2005).

7. Implementation of energy efficiency measures are associated with disturbance to the home, the hassle, the upfront cost, suspicion of energy suppliers and the fear of commitment (Bertoldi et al, 2006).

4.9.1 Sources of capital

There are three sources of capital for the investments in an ESCO model. (a) ESCO may use its own internal funds or lease equipments. (b) Energy-user/clients may use their own internal funds or borrow from financial institutions (e.g. mortgage loan). Guarantee on energy savings is given to the clients but not to the financial institutions. (c) Third-party financing (TPF) means either the ESCO or the client borrow the financial sources from a third party, e.g. a bank, which assumes the rights to the energy savings or treats the project equipments as security for payment defaults (JRC, 2010).

Third party financing has had marginal role in the existing non-residential ESCO operations in the Nordic countries. However, to improve financing opportunities for energy efficient renovation of buildings, perspective ESCOs may tie-up with financial institutions. Car retailers, travel agents, electronic and durable goods retailers, kitchen suppliers cooperate with financing companies to offer their customers low interest loans or a flexible payment schedule for the total capital cost (cost of product or service + interests + administrative costs) spread over certain months or years.

4.9.2 Savings models

4.9.2.1 Guaranteed savings

In this scheme, an ESCO takes over the entire performance and design risk and guarantees a certain level of energy (not cost) savings to the client. The client may use the guaranteed savings contract to get financing from banks or other financial institutions. However, clients may not be interested to assume the investment repayment risk. This is the most common form of agreement till date in the non-residential sectors (JRC, 2010).

It may be difficult to give a guarantee on *actual* energy savings in the event of energy efficient renovation of single-family houses, mainly due to the inability of the ESCO to control occupant behaviour (e.g. indoor temperature, window openings, hot water use). However, a guarantee on *theoretical* energy savings potential could be given based on calculations of technical performance of energy efficiency measures. The disadvantage of this is that the house owner cannot verify himself what is the right calculations. (S)He has to trust the experts.

In the European Union, there are two specific examples of guaranteed savings models in the residential sector.

Example 1: Pay As You Save (PAYS) pilots in United Kingdom

Five pilot projects to test the feasibility of variants of "Pay As You Save" approach is being run (December 2009 – April 2011) in the United Kingdom to test different approaches to partnership, marketing, billing and delivery mechanism (BPIE, 2010; EEPH, 2010). Under the scheme, homeowners are able to enter into very long financing arrangements to pay for energy efficiency improvements to homes. They repay the finance through instalments that are lower than their predicted energy bill savings. The renovation cost is attached to the home, not the homeowners. This is because homeowners move out of a property on average every 12 years, which is considerably shorter than payback period of many energy efficiency measures. Modelling work (EEPH, 2010) has shown that a PAYS approach is most viable with long contract lengths (35-40 years), so that they coincide with lifetime of key energy efficiency measures. This requires legislative changes that encourages acceptance of these long term investments, for example, by attaching a PAYS charge to a property so that a repayment schedule automatically passes from one homeowner to the next at the point of sale (BPIE, 2010; EEPH, 2010). Moreover, under this scheme, investment subsidy may be required to implement high investment measures as the energy cost savings may not cover the investment costs of such measures (EEPH, 2010).

Example 2: Sun energy Baltic, Latvia (source: Sun Energy Baltic, 2010)

Sun Energy Baltic Ltd is an energy service company (ESCO) in Latvia which offers long term contract (20 years) for the renovation of apartment buildings in that country. It invests own funds, combined with loans and subsidies, for extensive renovation, modernization and conservation of existing buildings. The company takes all the technical and financial risks, liabilities and responsibilities needed to realize the energy savings. This includes repayment of loans and the maintenance for 20 years of everything the company has changed or improved. The company guarantees an indoor temperature of 21.5°C from 1 October till 30 April through a new heating system with individual regulation and monitoring. During the contract period flat-owners pay for the same amount of energy (similar to guarantee on energy, not cost) as before the renovation. The company repays the investments and earns profit from the money/energy saved from the renovation. An example of their business is the renovation of a 9-storey building consisting of 36 flats in Valmiera, Latvia.

4.9.2.2 Shared savings

Under a shared savings contract the cost savings are split between the customer and the ESCO for a pre-determined time period. The share depends on the size of the project, the length of the contract and the risks taken by the ESCO and the client. The shared risks are related to performance of the implemented measures and energy price fluctuations. Typically, the ESCO takes the underlying customer credit risk, e.g. loss due to client bankruptcy because it obtains loan from financial institutions on the basis of the anticipated savings payments from the customer. The shared saving contractual arrangement may make ESCOs too indebted to get financing for new projects, while small and/or new ESCOs with limited financial resources and no credit history may find it difficult to borrow money and enter the market. The attention is likely to be on projects with short payback times. Thus, the shared savings concept may limit long-term ESCO market growth (JRC, 2010)

Under this model for energy efficient renovation of single-family houses, occupants have an incentive to save energy, but there is no guarantee that they will commit to a specific level of energy saving. In such a case it will be difficult for the ESCO to obtain financing from a bank based on anticipated cost

savings of the client. There might be significant credit risk for the ESCO, e.g. if the economic situation of the homeowner worsens. Furthermore, this form of contract may also influence the ease at which a house may be sold, since perspective buyers may or may not like to continue with the existing contract.

5 PROS AND CONS OF FINANCING OPTIONS FOR ENERGY EFFICIENCY RENOVATION OF SINGLE FAMILY HOUSES

The advantages and disadvantages of the possible financing methods mentioned in Chapter 4 are summarized in Table 4 below.

Table 4: Comparative assessment of various financing options.

Financing options	Advantages	Disadvantages
Homeowner's own resources	1. Can implement measures at own will, independent of external agencies 2. Perceived as cheaper than a loan	1. Could be invested in other profitable ventures (opportunity cost)
Mortgage refinancing	1. Cheaper than personal loan 2. Existing financing systems used 3. Low risks for banks 4. Motivates for an evaluation of the value of the house before and after renovation. An expected higher value of the house opens for an increase of the mortgage ceiling	1. Legal restrictions on upper limit of mortgage (e.g. 85% in Sweden) 2. Depends on status of current mortgage 3. Depends on household financial condition 4. A certificate of current value of the house may be required
Flex-loan	1. Same as for mortgage refinancing 1, 2, 3, 4. 2. Gives the flexibility for the house owner to do the investment whenever he wants without the need of an approval from the bank.	1. Same as for mortgage refinancing1, 2, 3, 4. 2. The flexibility is available for any type of investment or expenditure. Energy efficient investments therefore has to compete with "fulfilment of other dreams"
Personal loan	1. Easier to get than mortgage finance	1. More expensive than mortgage finance
Financing by service providers of one-stop shop	1. Supports homeowners who may not avail mortgage financing 2. Cost of financing may be similar to mortgage financing if service provider collaborate with commercial banks	1. Cost of financing may be high if the service provider take greater financial risks
Preferential loans	1. Increases attractiveness of energy renovations 2. Low income households may obtain such loan	1. May increase burden on state exchequer 2. May be a bad debt for the bank, if household do not pay back as they have low income
Subsidies/grants/tax deductions	1. Attract customers who maybe otherwise would not do anything 2. Increases attractiveness of energy renovations 3. Tax deduction option likely to have less bureaucracy 4. Incentives for energy efficiency measures are a signal from the government that such actions are good to be implemented	1. Increases burden on state exchequer 2. Subsidy amount may not be attractive 3. Subsidy application procedure may be complicated and time-taking 4. Many existing subsidy programs may lead to sub-optimized solutions 5. Tax deduction options often are of a general character and not only incentives for energy efficient renovation.
Credit card	1. Easily available to a certain limit 2. No interest cost till the due date of the bill payment	1. Most expensive option 2. Credit limit
Energy savings constitute regular payment for investments (ESCO concept)	1. Could be one of the best options to attract customers 2. No cost to the customer	1. Difficult to show profitability of some options 2. Such concepts do not exist in Nordic countries

6 CONCLUSIONS

The one-stop-shop service for energy efficient renovation of single-family houses is a concept similar to the ESCO concept. But, the difference is that the one-stop-shop service providers in Nordic countries, at present, are less likely to give any guarantee on actual savings in energy use or cost. It is possible that they may consider offering a guarantee on energy savings based on theoretical calculations. The guaranteed energy savings concept for residential buildings is emerging in some European countries. Table 4 in Chapter 5 suggests that there are advantages and disadvantages with all financing options. Following suggested measures may improve the situation.

1. Flexible mortgage refinancing

In Nordic countries, the best option to finance energy efficiency improvements seems to be that one-stop-shop service providers collaborate with commercial banks to offer mortgage refinancing. Such a mechanism is convenient for the homeowners and less risky for the entrepreneur. There will be low transaction cost as the existing financial infrastructure could be used. Banks will have a bigger credit base and an energy efficient renovated house means less risky asset. Homeowners are likely to have an increased capacity to repay the loan due to a lower energy cost. The investment cost burden is also less visible as amortization period is long and interest rate is significantly lower than the market rate. However, the need to self-finance the amount not covered in the mortgage loan and a higher cost for the top loan in some countries may hinder energy efficiency renovation. National governments should provide soft loans or subsidies to cover the investment cost beyond the mortgage (base) loan.

Special attention should be given to financing for energy efficient renovation of houses that were recently purchased using mortgage finance. Banks usually depend on a post renovation valuation of such a house for mortgage refinancing. In such circumstances, before a house is renovated, homeowners are unsure about the degree to which the mortgage refinancing would cover the investment cost. One option to overcome this financial uncertainty is that banks, which often collaborate with real estate agents, would consider an energy efficient renovation plan prepared by an entrepreneur and pre-evaluate the post-renovation value of a house. This could form the basis for the bank to confirm the homeowner and the entrepreneur that certain amount of investment cost would be covered by mortgage refinancing. The rest may be covered by the government sponsored soft loan or investment subsidies.

A second option to finance energy renovation of newly-bought houses is that the renovation companies maintain a database of energy declaration of such houses and contact the owners few years after the house is bought. The house price might have increased by then, which would make it possible to avail mortgage refinancing.

2. Creation of a special fund for energy efficiency financing

A special fund with public financing could be established to be used by companies implementing energy efficiency measures. The following steps were suggested by the Klinckenberg Consultants (2006).

I. The project developer (i.e. service provider of one-stop-shop) identifies, develops and contracts a project with a project owner.
II. The Fund reviews and approves the project and disburses to a pre-qualified bank.
III. A pre-selected supplier and installer (S&I) provides and installs the improvements.
IV. After communication on satisfactory installation, the bank disburses to the S&I.
V. The bank collects payment from the project owner in the agreed time period.
VI. The project developer evaluates and communicates the project results to the bank and Fund.
VII. The bank repays the Fund, completion payment to the S&I and evaluation payment to the project developer.

3. Tax deduction linked to energy efficiency measures

From July 01, 2009 private persons in Sweden can get tax deduction (ROT program) amounting to 50% of the labour cost for specific repair, maintenance, renovation, or extension works in a single-family house or tenant-owned apartment. The maximum claim allowed is SEK 50000/person/year. This deduction can be combined with subsidies to replace resistance heaters or to decontaminate radon in single family houses. Similar deduction amounting to €3000/person/year is available in Finland. Such programs may encourage implementation of energy efficiency measures to some extent. For example, some window sellers/installers in Sweden suggested that the ROT program was more effective than the investment subsidy (from 2006-2008) in encouraging homeowners to install new windows (Nair et al., 2010b). Often tax deduction is used for non-energy related measures such as improving kitchen, painting, a new or improved balcony, or house cleaning. An amendment to the tax deduction programs to incorporate specific requirements regarding energy efficiency of implemented measures would increase financing for energy efficient renovation. Also, higher tax deduction could be offered for energy efficiency improvement than for other renovation.

4. Tax deduction on savings put aside for future energy efficient renovation

Norwegian authorities have a special incitement called “Young people’s housing savings” (BSU) for persons less than 34 years old to save money for their first dwelling. You may save max 20.000 NOK a year and accumulate NOK 150.000 on a special account. These money is then later used as the own capital in combination with mortgage loan from their bank to buy a house. If the money is used for other purposes the reduced tax has to be paid (Skatteetaten, 2011). It is interesting to note that all banks offer their best terms for such accounts. A similar system could be introduced to households to save money for energy efficient renovation.

5. Integrated financing model

Implementation of energy efficiency measures typically lowers energy costs and improved indoor comfort. However, homeowners may not realize the cost effectiveness of the energy investments, if the energy bill and the cost of renovation financing (e.g. monthly cost of mortgage financing) are separate as is done traditionally. It would be relevant to establish an integrated model where the payments of the loan and the energy bill come on the same invoice. For example, DONG Energy offers financing to Danish homeowners to purchase energy efficient gas boilers. Homeowners receive one invoice which contains the cost of gas and financing cost of the boiler. Such integrated financing models are simple and efficient tools to inform the homeowners the cost-efficiency of energy renovation investment, while the banks and utilities may attract more customers and expand their business. However, this requires a strong cooperation between bank and energy utility company.

7 REFERENCES

Aalbers, R., de Groot, H.L.F., Ossokina, I.V., Volleberg, H.R.J., 2004. Subsidising the adoption of energy efficient technologies: An empirical analysis of the free-rider effect. In Blok, K., de Groot, H.L.F, Luiten, E.E.M., Reitbergen, M.G. (Eds) The effectiveness of policy instruments for energy efficiency improvements in firms: The Dutch experience, Kluwer Academic Publishers, The Netherlands.

Bertoldi, P. and Rezessy, S. 2005. Energy Service Companies in Europe Status Report 2005. Ispra, Italy: European Commission DG Joint Research Center.

Bertoldi, P., Hinnells, M., Rezessy, S. 2006 Liberating the power of Energy Services and ESCOs for the residential sector in a liberalised energy market. Paper presented at the EEDAL conference 21-23 June in London.

Brown, M., 2001. Market failures and barriers as a basis for clean energy policies, Energy Policy, 29(14): 1197-1207.

BPIE, 2010. Financing Energy Efficiency (EE) in Buildings. Input to the European Roundtable, 16 November, 2010, Building Performance Institute Europe, Brussels,

ECS, 2004. Investing in Energy Efficiency, Removing the Barriers, Energy Charter Secretariat, Brussels.

EEPH, 2010. New Finance Mechanisms for Housing, Energy Efficiency Partnership for Homes, http://www.eeph.org.uk/.

EuroACE, 2010. Making Money work for Buildings: financial and fiscal instrumentsfor energy efficiency in buildings, A report by Klinckenberg Consultants for EuroACE, September 2010.

European Parliament, 2010. Energy Efficiency Action Plan: focus on efficient buildings and implementing existing legislation, Press release, December 15, 2010, REF. : 20101215IPR10136, http://www.europarl.europa.eu/en/pressroom/content/20101215IPR10136/html/Energy-efficiency-efficient-buildings-and-implementing-existing-legislation, accessed on December 15, 2010.

Golove, W.H and Eto, J.H., 1996. Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency, Lawrence Berkeley National Laboratory, Berkeley.

Grim, M. 2005. Energy Performance Contracting: an opportunity for the private service building sector or a tool for public buildings only? In: Proceedings of the ECEEE Summer Study 2005.

Haavik, T., Aabrekk, S., Tommerup, H., Svendsen, S., Mahapatra, K., Gustavsson, L., Paiho, S., and Ala-Juusela, M., 2011. Report on stakeholders interests, Deliverable D2.1, Successful Sustainable Renovation Business for Single-Family Houses - SuccessFamilies.

Hermelink, A.H., 2009. How deep to go: Remarks on how to find the cost-optimal level for building renovation, PBENDE084668, Report commissioned by European Council for an Energy Efficient Economy, http://www.eceee.org/press/Understanding_the_economics_of_renovation, accessed on March 17, 2011.

Howat, J. and Oppenheim, J., 1999. Analysis of low-income benefits in determining cost-effectiveness of energy efficiency programs, National Consumer Law Center, http://democracyandregulation.com/attachments/18/C-E_of_DSM_paper_-_Final.doc, accessed on January 11, 2011.

IEA, 2008. Promoting Energy Efficiency Investments: Case Studies in the Residential Sector, International Energy Agency, http://www.iea.org/textbase/nppdf/free/2008/PromotingEE2008.pdf, web access on October 08, 2010.

Jakob, M., 2006.Marginal costs and co-benefits of energy efficiency investments, Energy Policy, 34(2): 172-187.

Javaroni, M.C., de Aragao Neto, R.M. 2006. Is performance contracting a real business opportunity for residential consumers? Paper presented at the EEDAL conference 21-23 June in London.

Jensen, O.M., 2009. Virkemidler til fremme af energibesparelser i bygninger [Means to promote energy savings in buildings], SBi, 2009:06, Statens Byggeforskingsinstitute, Aalborg Universitetet

JRC, 201. Energy Services Companies, European Commission Joint Research Centre - Institute for Energy, http://re.jrc.ec.europa.eu/energyefficiency/ESCO/index.htm, accessed on October 11, 2010.

Joosen, S., M. Harmelink, K. Blok, 2004: Utiliteitsbouw: EIA/EINP/VAMIL. In: Evaluatie van het klimaatbeleid in de gebouwde omgeving, 1995-2005, Ecofys bv, Utrecht, pp. 143-161.

Klinckenberg Consultants, 2006. Investing in building energy efficiency in the enlarged European Union, A report prepared for the European Alliance of Companies for Energy Efficiency in Buildings (EuroACE), www.euroace.org.

Korytarova, K., 2006. Evaluation of KfW soft loans for building modernisation within the framework of the AID-EE project, Project executed within the framework of the Energy Intelligence for Europe program, http://www.aid-ee.org/documents/000003KfWbuildingprogramme-Germany.pdf, accessed on Nov. 26, 2010.

Kragh J, and Rose J., 2011. Energy renovation of single-family houses in Denmark utilising long-term financing based on equity, Applied Energy, doi:10.1016/j.apenergy.2010.12.049.

Mahapatra, K. and Gustavsson, L., 2008. An adopter-centric approach to analyze the diffusion patterns of innovative residential heating systems in Sweden, Energy Policy, 36:577-590.

Nair, G., Gustavsson, L., and Mahapatra, K., 2010a. Owners' perception on the adoption of building envelope energy efficiency measures in Swedish detached houses, Applied Energy, 87: 2411-2419.

Nair, G., Gustavsson, L., and Mahapatra, K., 2010b. Role of sellers/installers in the diffusion of energy efficient windows in Swedish detached houses, SB 10 Finland: Sustainable Community – buildingSMARTTM, 22 – 24 September, Espoo, Finland.

Nair, G., Gustavsson, L., and Mahapatra, K., 2010c. Factors influencing energy efficiency investments in existing Swedish residential buildings, Energy Policy, 38: 2956-2963.

Persson, L., 2010. Email from Lisa Persson of Fastighetsbyrån, Östersund, on June 04, 2010, about the impact of energy efficiency measures on market value of a house.

Ramesohl, S. and Dudda, C., 2001.Barriers to energy service contracting and the role of standardised measurement and verification schemes as a tool to remove them, eceee 2001 Summer Study Proceedings, eceee, Stockholm.

Rockwool, 2010. Germany – top of the class, http://www.rockwool.com/energy+efficiency/inspiration+catalogue/favourable+loans+in+germany, accessed on Sept. 06, 2010.

Skatteetaten, 2011. Boligsparing for ungdom (BSU), Norwegian Tax Authorities, http://www.skatteetaten.no/no/Alt-om/Boligsparing-for-ungdom-BSU/, web access on 21th March 2011.

Skumatz, L.A., Dickerson, C.A., and Coaters, B., 2000. Non-energy benefits in the residential and non-residential sectors – innovative measurement and results for participant benefits, Proceedings from the 2000 ACEEE Summer Study on Energy Efficiency in Building, 8.353-364, August 2000, Washington, DC.

Svenska Bankföreningen, 2010. Bolånetak skapar gott konsumentskydd men snedvrider konkurrensen, Press release, June 09, 2010, Svenska Bankföreningen, http://www.swedishbankers.se/web/bf.nsf/($All)/3C67583E5457C372C125773D002A7376?OpenDocument.

The American Heritage® Dictionary, 2000 (updated in 2009). The American Heritage® Dictionary of the English Language, Fourth Edition, Houghton Mifflin Company.

Thompson, P., 1997. Evaluation energy efficiency investments: accounting for risk in the discounting process, *Energy Policy*, 25(12): 989-996.

Tommerup, H., Vanhoutteghem, L., Svendsen, S., Mahapatra, K., Gustavsson, L., Haavik, T., Aabrekk, S., Paiho, S., and Ala-Juusela, M., 2011. Analysis of promising sustainable renovation concepts, Deliverable D1.2, Successful Sustainable Renovation Business for Single-Family Houses - SuccessFamilies.

Train, K.E., 1994. Estimation of Net Savings from Energy-Conservation Programs, Energy, 19: 423-441.

Vainio, T., Jaakkonen, L., Nippala, E., Lehtinen, E. & Isaksson, K. 2002. Repair, maintenance and improvement work in Finland. 60 p. + app. 25 p. (VTT Research Notes 2154). ISBN 951–38–6068–X. http://www.vtt.fi/inf/pdf/tiedotteet/2002/T2154.pdf (in Finnish, English abstract).